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COMMUNICATION

Determination of heavy metals in the dates (*P. dactylifera* L.) of Balochistan (Panjgoor and Turbat)

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ABSTRACT

Background and objective: Dates are a high-nutritional-value food that is suitable for humans since they contain major nutrients such as carbohydrates, proteins, fats, and dietary fibers. The current study aimed to determine the level of some heavy metals such as Fe, Pb, Co, Mn, Cd, Cu in the dates (*P. dactylifera* L.) taken from various regions of Balochistan (Panjgoor and Turbat).
Method: The analysis was performed using the atomic absorption spectrophotometer.
Results: The results indicated the presence of all the analyzed heavy metals in the samples. The mean detected concentration order of heavy metals is Fe > Pb > Cu > Mn > Cd > Co. The highest average level of Fe was detected and the least average level of Co was determined in dates.
Conclusions: It is concluded that the levels of all the detected heavy metals in all varieties of dates were found within the admissible limit of WHO/FAO and ATSDR.

Keywords atomic absorption spectrophotometer, Balochistan, date fruits, heavy metals

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INTRODUCTION

The date palm (*P. dactylifera* L.) is the world's oldest cultivated fruit tree, with significant socioeconomic and nutritional importance. The date palm is widely dispersed globally including Africa, Asia, Arabian countries, and the Middle East.[1] Pakistan is the world's fifth largest date producer. 74.80 thousand hectares area of Pakistan is under dates palm which yield of 426.80 thousand tons of dates.[2] Baluchistan plays a significant role in the country's date production, accounting for 51 % of the country's entire output.[3] Mekran Division contributes significantly 45% to Baluchistan's total date fruit output. Historically, the area has been recognized for its date production. This region's climate and geography are ideal for the cultivation of date palms, resulting in a harvest of exceptional quality.[2]

Dates are a high-nutritional-value food that is suitable for humans since they contain major nutrients such as carbohydrates, proteins, fats, and dietary fibers, as well as some

vitamins such as vitamins (A & C) and a substantial number of antioxidants and polyphenols.[4,5] In addition, it is regarded as a natural supply of minerals, such as calcium, iron, magnesium.[6,7] sodium, and phosphorus, because it includes highly required levels for human body construction Recent investigations have described this action of date fruits. It was discovered that seven dates, or roughly 100 grammes of dates, provide the human body with all of its daily needs for magnesium, manganese, copper, and Sulphur, half of its daily needs for iron, and a quarter of its daily needs for calcium and potassium. Dates also contain high levels of trace elements.[8] There is five times as much fluorine as other fruits, according to estimates.[9] In addition to being an important source of energy, dates also have a high percentage of calories, since one kilograms of dates has 3000 calories.

Rapid urbanization has led to an increase in human-caused pollution, such as the use of fossil fuels. Emissions from cars driven by fossil fuels, factories, farms, sewage sludge, and incinerated trash are the primary causes of air pollution.[10] This type of pollution, together with dust storms, is responsible for heavy metal accumulation in the environment.[11] Pollutants typically condense on the ground and other objects, including exposed plant components.[12] Lead (Pb) and cadmium (Cd) the most common air contaminants, and their ingested amounts are dangerous for humans.[13]

Human exposure to heavy metals has increased dramatically in recent years, particularly in urban and industrial settings where harmful chemicals and metals are ubiquitous and difficult to avoid. Dust accumulated on fruits consumed by people is a significant source of heavy metal exposure. Scientists consider standards such as the presence of additional compounds and the nature of the sample itself to establish what constitutes a hazardous level of contaminants in a sample. Because there is no general norm across countries, plant species, or processing processes, each country has its own set of rules addressing the permitted quantities of potentially dangerous metals in herbal products.[14] Humans are especially vulnerable to heavy metal air pollution because it has the potential to poison their food supply. Consuming this fruit may pose serious health hazards due to the high quantities of these pollutants.[15] It is imperative to estimate their amounts in contaminated food in order to protect the public's health and safety.

This study aimed to examine the level of heavy metals (Fe, Pb, Mn, Cu, Cd, and Co) in the fruits of dates gathered from Panjgoor and Turbat, the regions of the Balochistan Province and to compare the obtained results with the permissible limits given by WHO/FAO.

MATERIALS AND METHODS

Sample collection

The samples of fruit of dates were collected in polyethylene bags randomly from Pamjgoor and Turbat, regions of the Baluchistan Province and were brought to the laboratory of the Department of Chemistry, University of Balochistan, Quetta. Only the edible portions were used for the analysis of heavy metals.

Sample preparation

The collected samples were washed with distilled water to remove dust particles. Seeds were removed and the fruit of dates ware dried in oven at temperature of 100 °C until constant weight was acquired. The dried samples were grinded by using a ceramic marter and pestle. 1 g of each powdered samples was taken in a flask and was digested.[16] The mixture of 5 ml of 70% nitric acid and 2 ml of 30 % hydrogen peroxide was used. Then, the beaker was sealed with a watch glass and placed in a 60 °C sand bath for whole night. The sample was vaporized almost fully. Then, the samples were cooled and diluted with distilled water up to 10 ml. Whatman filter paper 41 was used for the filtration of solution. The samples were kept for further analysis.

Instrumentation

Three replicates of the specimens were examined for each metal using atomic absorption spectrophotometer. The acetylene was used as a fuel and air was used as oxidants. The samples were evaluated for various metals such as Fe, Pb, Mn, Cu, Cd and Co.

RESULTS AND DISCUSSION

The metals that were detected in this study are Fe, Pb, Mn, Cu, Cd and Co. Different concentrations were observed in different samples for each metal depending upon the site of samples. The mean values with standard deviations of different metals are shown in Table 1.

Table 1 **The mean values with standard deviations of various metals in the fruit of dates (ppm).**

	Metals					
Samples	**Fe**	**Pb**	**Mn**	**Cu**	**Cd**	**Co**
Berni	0.84±0.16	0.21±0.05	0.14±0.06	0.26±0.03	0.01±0.005	0.006±0.004
Sheigoo	1.39±0.21	0.29±0.19	0.1±0.06	0.13±0.05	0.02±0.005	0.003±0.001
Zard	1.27±0.23	0.22±0.09	0.09±0.04	0.10±0.06	0.02±0.005	0.009±0.004
Perz	1.92±0.05	0.25±0.12	0.10±0.06	0.12±0.05	0.02±0.005	0.009±0.004

Data expressed as mean±SD.

Iron (Fe)

It is a crucial element for the well being of human. It is plays vital role and act as the main constituent of hemoglobin, protein and enzymes. It also takes part in metabolism and transportation of gases in or out of the body.[17] The present study showed the highest level of Fe (1.92 ppm) in Perz Dates among the samples analyzed while the smallest amount (0.84 ppm) in Berni Dates. The obtained result of Fe was compared with WHO/FAO (2001

& 1994) values (425 ppm) set for fruits which indicated that the level of Fe was within the range in all varieties of dates.

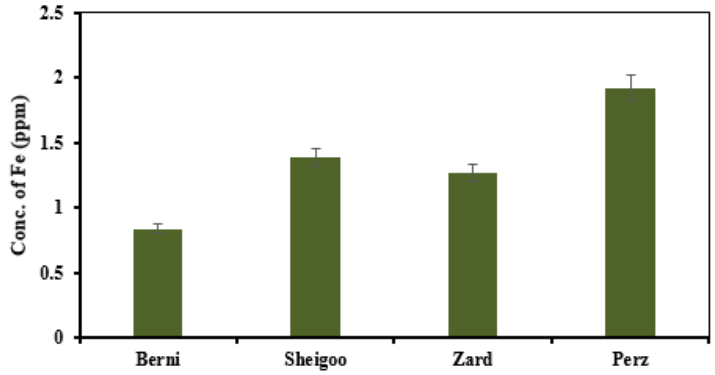

Figure 1 **Concentration of iron.**

Lead (Pb)

It is a non-essential heavy metal that is extremely toxic to living organisms, plants, and animals; its use in very small amounts can cause environmental and health problems that affect multiple body systems; Pb can enter the body via inhaling polluted air; it then travels through the body and is accumulated in the bones. It has an impact on the central nervous system, children's I.Q., and behavior. Changes in sperms reduce fertility in men and raise the risk of miscarriage and birth abnormalities in women.[18] Its sources are pesticides, automobile exhausts.[19] In current study, the highest concentration of lead was detected in Berni Dates (0.42 ppm) among the specimens analyzed while the least level (0.22 ppm) in Zard Dates. The obtained result of Pb was compared with WHO/FAO (2001 & 1994) values (0.3 ppm) set for fruits which indicated that the level of Pb was within the range in all varieties of dates used for analysis.

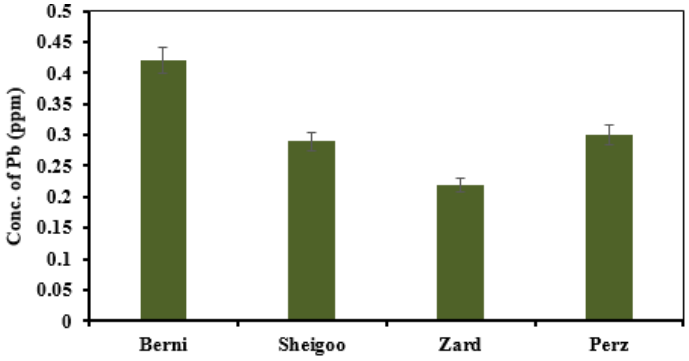

Figure 2 **Concentration of lead.**

Manganese (Mn)

It is a vital trace metal that acts as an antioxidant and aids in the metabolism of carbohydrates, proteins, and cholesterol. Mn is deposited in bones, skin, liver, and kidneys and the consumption is 2-5 mg per day.[20] The highest amount of Mn (0.14 ppm) is found in Berni Dates Fruit while the least amount (0.09 ppm) is detected in Zard Dates Fruit. In addition, similar amount (0.1 ppm) of Mn is found in Sheigo and Perz Dates Fruits. When compared with standard values (500 ppm) set for fruits by WHO/FAO (2001 & 1994), the level of Mn was found within the range in all used types of dates.

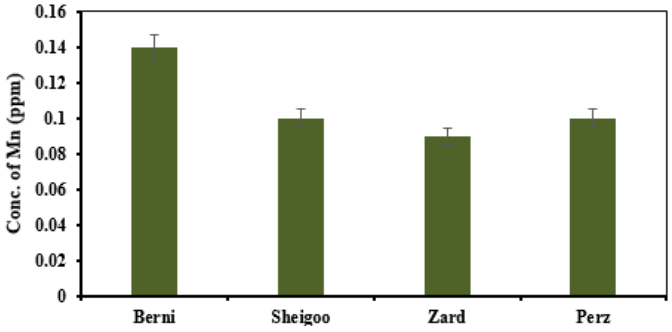

Figure 3 **Concentration of manganese.**

Copper (Cu)

Copper has vast applications in the field of industries for various purposes. The main sources of the copper are pesticides, and paper industry. The greater concentration of copper affects the health of human adversely. It may cause blood pressure, skin irritation, stomach nausea and vomiting etc.[17] The analysis indicated highest amount of copper (0.26 ppm) in Berni Dates among all the samples and smallest amount (0.1ppm) in Zard Dates. On comparison with WHO/FAO (1996) values (40 ppm) set for fruits, the concentration of Cu was found within the range in all used varieties of dates.

Cadmium (Cd)

Cadmium sources are steel, plastic industries, electroplating, Ni-Cd batteries etc. The higher concentration of Cd than admissible limit may have adverse effect on human health. It can damage the kidney, skeleton and can also cause cancer.[19] This study found same quantity (0.02 ppm) in Shego, Zard and Perz while the least amount (0.01 ppm) in Berni Dates. The result obtained for cadmium was compared with WHO/FAO values (0.1 ppm) (2001 & 1994) set for fruits, was found within permissible limits in all varieties of dates used for analysis.

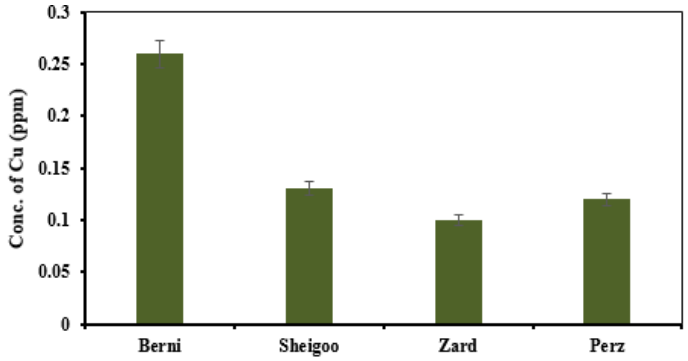

Figure 4 **Concentration of copper.**

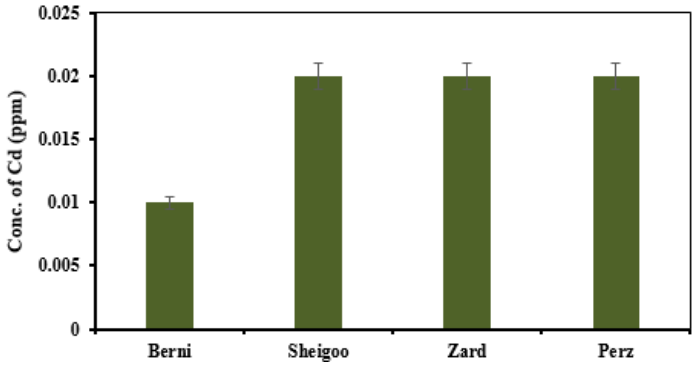

Figure 5 **Concentration of cadmium.**

Cobalt (Co)

Cobalt is an element that occurs naturally. It is an essential part of Vitamin B12, which aids in the production of red blood cells and Cobalt works as zinc and manganese. As a result, it can substitute for Zn in various biological processes. Anemia is caused by a lack of Co. Co consumption of more over 30mg/day causes toxicity in humans, which can alter heart muscles, induce congestive heart failure, and create digestive and skin problems.[21] In present study, the level of cobalt in Zard and Perz Dates fruits are almost same and highest amount (0.009 ppm) among the analyzed samples while the least amount (0.003 ppm) is found in Sheigo dates. On comparison with ASTDR (1994) values (0.05-1 ppm) set for fruits, detected level of cobalt was found within permissible limits in all varieties of dates used.

CONCLUSIONS

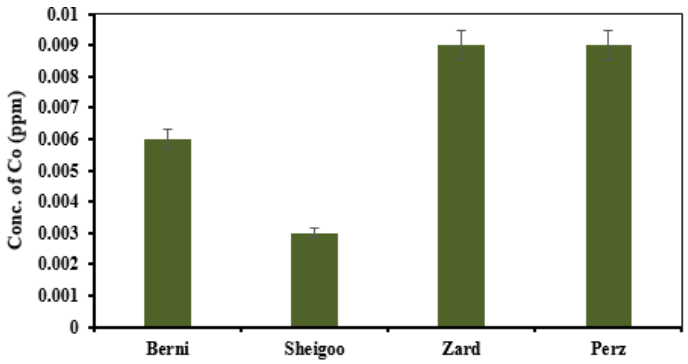

Figure 6 **Concentration of cobalt.**

According to the findings, date fruits revealed significant quantities of Iron, lead, manganese, copper, cadmium, and cobalt. The average concentrations of Fe in date palm fruit were found the highest of all. The least average concentration of Co was detected in date palm fruits. The dates fruits may be utilized as a bio indicator for pollution and may be suggested for ingestion after washing as a precautionary step for human health. Nevertheless, the data displays that the heavy metal concentrations in date palm fruits were within the acceptable levels of WHO/FAO and ATSDR.

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DECLARATIONS

Authors' contributions

Conceptualization: RA. Data curation: NK. Funding acquisition: AK, Investigation: methodology: RA, NK, AK, S, AT. Resources: S: Software: AT. Writing-original draft, review & editing: RA, NK, AK, S, AT. All the authors have reviewed and approved the final version before publishing.

Conflict of interest

The authors declare no conflict of interest.

Ethical approvals

This study doesn't include humans or animals in any of its protocols.

Data availability

The data that support the findings of this study is available from the corresponding author, upon reasonable request.

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